INFLUENCE OF NOSTRIL BREATHING MANIPULATION ON SELECTED PSYCHOLOGICAL AND PHYSIOLOGICAL VARIABLES OF SCHOOL GOING STUDENTS

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Certificate

I hereby declare that the synopsis ***"Influence of Nostril Breathing Manipulation on Selected Psychological and Physiological Variables of School Going Students"*** being submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in Yogic Sciences under Department of Yogic Sciences of Lakshmibai National Institute of Physical Education, Gwalior, MP, India, during the academic year 2021 2022. It is a bona fide record of original work carried out under the supervision of Dr. Payel Das and co-supervision of Dr. Srinivasan Lakshmi Kandhan, and has not been submitted in full or part to any other university or institute for a degree or diploma. Further, it is certified that the synopsis is plagiarism-free and the proof has been submitted.

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Abstract

The proposed research intends to investigate the impact of specific breathing techniques on various physiological and psychological factors among adolescents attending school. A total of sixty students, comprising both genders and aged between 12 and 17 years, will be randomly selected from Gwalior, India, and evenly divided into four groups: three intervention groups and one control group. The intervention groups will engage in different types of breathing exercises, while the control group will not participate in any intervention. The study will evaluate several physiological factors, such as neural activity patterns, cardiovascular and respiratory responses, muscular performance, and electrodermal activity. Furthermore, psychological factors related to mental skills and cognitive performance will be assessed using a standardized psychometric instrument. Data collection will take place at three intervals: baseline, mid-point, and post-intervention to monitor changes over time. The physiological data will be analyzed using Mixed Design Repeated Measures ANOVA, whereas the psychological data will be evaluated through a Two-Way Repeated Measures MANOVA. The results of this research are anticipated to provide valuable insights into the effectiveness of breath-focused practices on neurophysiological regulation and psychological health in adolescents, while keeping the specific details of the training protocols confidential.

Keywords: *Alpha Brain Waves, Beta Brain Waves, Surface Electromyography, Galvanic Skin Response, Swara Yoga, Unilateral and Bilateral Breathing Technique, Mental Skills, Adolescents*

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CHAPTER – I
INTRODUCTION

1.1 Yoga is a well-established practice that fosters a balanced and harmonious lifestyle. It encompasses various aspects of human existence—physical, mental, emotional, and spiritual—by promoting the integration of body, breath, and mind. The Sanskrit term 'yuj', which translates to 'to unite', encapsulates yoga's role as a connecting force between individual and universal consciousness. In practice, yoga nurtures inner peace and well-being through organized activities such as 'asana' (postures), 'pranayama' (breathing techniques), 'mudra' (gestures), 'bandha' (energy locks), 'shatkarma' (cleansing techniques), and meditation. Typically, yoga begins by addressing the most accessible aspect of human experience—the physical body. Imbalances at this level can lead to poor coordination among bodily systems, potentially resulting in various health issues. By restoring physiological equilibrium and improving neuromuscular coordination, yoga seeks to enhance the body's performance. Furthermore, it aids in managing emotional turmoil, psychological stress, and cognitive disarray, equipping individuals with effective strategies to navigate life's challenges.

1.2 Swara Yoga, an ancient yogic discipline, is grounded in traditional tantric texts such as 'Shiva Swarodaya' and provides a unique yogic method for self-regulation through breath awareness and manipulation. This discipline, conveyed through a dialogue between Shiva and Parvati, views breath as a vessel of life energy (prana) and classifies breathing into three swaras based on nostril dominance. Ida (left nostril) is linked to cooling, introspection, and parasympathetic effects, while Pingala (right nostril) is associated with heating, action-oriented behavior, and sympathetic functions. Sushumna, which involves both nostrils, signifies balance and heightened awareness. Swara Yoga perceives breath as more than a mere physiological function; it serves as a channel of bioenergy that impacts bodily rhythms, neural activity, and mental states. Practitioners can adjust autonomic functions and influence the subtle energies that affect mental and emotional well-being by employing specific nostril-based breathing techniques.

The concept of Swara Yoga, derived from the term 'Swara' meaning 'inner sound' or rhythm of breath, when combined with yogic awareness, becomes a practical method for achieving life

balance. Ancient yogic sages devised Swara Yoga to comprehend and manage the flow of 'prana' through nasal dominance. Contemporary science corroborates this perspective, demonstrating how ion exchange and electromagnetic patterns within the body influence neurological and psychological functions.

1.3 The cyclical variation in nostril activity, known as the ***nasal cycle***, corresponds with shifts in sympathetic and parasympathetic nervous system dominance. Activity in the left nostril generally promotes calming and introspective states through the parasympathetic system, whereas activity in the right nostril enhances energy and focus via the sympathetic system. A harmonious flow through both nostrils is thought to stabilize both physiological and psychological functions. The nasal cycle, characterized by the natural alternating airflow through the nostrils, is regulated by autonomic nervous system dominance. This rhythm of congestion and decongestion is recognized to affect brain hemisphere activity, respiratory efficiency, and emotional state. By consciously engaging with this rhythm through targeted pranayamas, one can facilitate beneficial changes in energy, focus, and mood.

1.4 Breathing Techniques in Swara Yoga: Swara Yoga utilizes specific breathing methods to engage distinct energetic and neural pathways: a. Suryabheda Pranayama (right nostril breathing): This technique stimulates the sympathetic nervous system, increases alertness, energizes the body, and activates beta brain waves. b. Chandrabheda Pranayama (left nostril breathing): This method activates the parasympathetic nervous system, encourages calmness and relaxation, and is associated with alpha brain wave activity. c. Nadi Shodhana Pranayama (alternate nostril breathing): This practice balances both brain hemispheres and harmonizes the autonomic nervous system, promoting equilibrium between the mind and body. Each technique offers distinct physiological and psychological benefits, positioning Swara Yoga as a potentially effective approach for improving mental performance and physical regulation, particularly in adolescents.

1.5 Rationale for the Current Study: Although many studies have investigated the immediate effects of nostril-specific breathing techniques, there is a notable lack of research focusing on the long-term effects of Swara Yoga practices, particularly among school-aged children. Furthermore, existing research often amalgamates various yogic interventions, complicating the

ability to discern the effects of nostril manipulation in isolation. This study seeks to fill that void by analyzing the individual and comparative impacts of Suryabheda, Chandrabheda, and Nadi Shodhana Pranayamas on selected physiological variables (including neural activity, autonomic balance, and respiratory function) and psychological variables (such as mental focus, stress response, and cognitive performance) in adolescents aged 12 to 17. In light of the growing academic and emotional pressures faced by students, this research has the potential to provide straightforward, cost-effective, and accessible strategies for enhancing student well-being and performance. Through organized interventions and systematic measurements over time, the outcomes of this study are anticipated to yield significant insights into the effectiveness of these practices.

STATEMENT OF THE PROBLEM

The present study shall investigate the influence of nostril-specific breathing techniques, based on Swara Yoga, on selected psychological and physiological variables among school going students.

OBJECTIVES OF THE STUDY

The primary objective of this study is to examine the influence of Swara Yoga, specifically, nostril breathing manipulation techniques, on selected physiological and psychological variables of school-going students, with a focus on enhancing their mental performance and overall well-being. To achieve this aim, the following specific objectives have been formulated:

a. To evaluate the impact of Swara Yoga practices on selected physiological and psychological parameters.
b. To assess the effect of Swara Yoga on selected psychological variables, including stress management, attention, and cognitive performance.
c. To analyze the influence of different durations of intervention (baseline, mid-point, and post-intervention) on physiological and psychological outcomes.
d. To examine the interaction effects between training duration and breathing technique on the selected physiological and psychological variables.

e. To investigate the long-term effects of nostril-specific breathing techniques, right nostril (Suryabheda), left nostril (Chandrabheda), and alternate nostril (Nadi Shodhana), on mental and physical health markers.
f. To compare the performance scores of various experimental groups practicing different breathing techniques under controlled conditions of nostril dominance.
g. To determine whether there are statistically significant differences between the experimental groups and the control group on selected outcome measures.
h. To assess the improvement in mental skills before and after the intervention period.
i. To measure the changes in physiological variables across the pre-test and post-test conditions.
j. To explore whether gender, age, or baseline fitness level moderates the effect of Swara Yoga on the measured variables.
k. To contribute empirical evidence supporting the integration of Swara Yoga practices into school wellness and mental health programs for adolescents.

RESEARCH QUESTIONS

The present study seeks to address the following research questions:

a. Do various Swara Yoga breathing techniques (right nostril, left nostril, and alternate nostril breathing) significantly influence selected physiological and psychological variables, regardless of the duration of practice?
b. Does the duration of the training program independently affect physiological variables, irrespective of the specific breathing technique applied?
c. Does the duration of the training program independently affect psychological variables, irrespective of the breathing technique used?
d. Is there a significant interaction between the type of breathing technique and the duration of practice in influencing the selected physiological and psychological outcomes?
e. Within each breathing technique group, does the duration of practice have a significant effect on selected physiological and psychological parameters?

f. Within each level of training duration, do the different nostril breathing methods have varying effects on the selected physiological and psychological variables?

HYPOTHESIS OF THE STUDY

Based on the review of relevant literature, it is hypothesized that both the duration of training and the specific breathing techniques will significantly influence selected physiological and psychological variables among school-going students. The following hypotheses have been formulated in line with the research questions:

1. Effect of Training (Breathing Technique):

Null Hypothesis (H_0): There will be no significant difference among the breathing training group means (unilateral left, unilateral right, bilateral, and control) in terms of psychological and physiological variables, irrespective of time.

Alternative Hypothesis (H_1): At least one group mean will significantly differ.

$$H_0: \mu \text{ unilateral left} = \mu \text{ unilateral right} = \mu \text{ bilateral} = \mu \text{ control}$$

$$H_1: \mu \text{ unilateral left} \neq \mu \text{ unilateral right} \neq \mu \text{ bilateral} \neq \mu \text{ control}$$

2. Effect of Time Duration:

Null Hypothesis (H_0): There will be no significant difference across the means of various time durations (initial, 6 weeks, and 12 weeks) for the selected physiological and psychological variables, regardless of training groups.

Alternative Hypothesis (H_1): At least one-time duration mean will significantly differ.

$$H_0: \mu \text{ initial} = \mu \text{ 6 weeks} = \mu \text{ 12 weeks}$$

H_1: μ initial ≠ μ 6 weeks ≠ μ 12 weeks

3. Interaction Effect Between Time and Training:

Null Hypothesis (H_0): There will be no significant interaction between the breathing technique groups and time duration in influencing the psychological and physiological variables.

Alternative Hypothesis (H_1): A significant interaction exists between breathing technique and time duration with respect to the selected variables.

If the interaction effect is found to be significant, the following sub-hypotheses will be examined:

a. Effect of Time Duration within Each Breathing Group:

Null Hypothesis (H_0): There will be no significant difference in physiological and psychological variables across different time durations within each breathing group.

Alternative Hypothesis (H_1): At least one-time duration will show a significant difference within each breathing group.

H_0: μ initial = μ 6 weeks = μ 12 weeks

H_1: μ initial ≠ μ 6 weeks ≠ μ 12 weeks

b. Effect of Breathing Group within Each Time Duration:

Null Hypothesis (H_0): There will be no significant difference among breathing groups (unilateral left, unilateral right, bilateral, and control) in each level of time duration.

Alternative Hypothesis (H_1): At least one breathing group will significantly differ within each time duration.

H_0: μ unilateral left = μ unilateral right = μ bilateral = μ control

H_1: μ unilateral left ≠ μ unilateral right ≠ μ bilateral ≠ μ control

DELIMITATIONS OF THE STUDY

In alignment with the researcher's interests, resources, and the feasible scope of investigation, the study has been confined to the following boundaries:

a. The participant pool will consist of sixty (60) students, including both boys and girls, drawn exclusively from a single educational institution located in Gwalior, India.
b. The age range of the selected participants will be strictly limited to 12 to 17 years.
c. The intervention will include three specific nostril breathing techniques derived from Swara Yoga.
d. The study will focus on a set of predefined physiological and psychological parameters, categorized as follows:
e. **Physiological Metrics:**
    1. Alpha brainwave activity
    2. Beta brainwave activity
    3. Heart Rate
    4. Respiratory Rate
    5. Muscular fatigue response
    6. Skin conductance level
f. **Psychological Domain:** Assessment of mental skill attributes based on the model developed by Stephen J. Bull (1996).

OPERATIONAL DEFINITIONS

To ensure conceptual clarity and consistency throughout the study, the following key terms are defined within the scope of this research:

1. **Swara Yoga:** A traditional yogic practice that emphasizes controlled breathing through specific nostrils—left (Ida), right (Pingala), or both (Sushumna). It aims to regulate physical and mental functions by influencing the body's energy channels and autonomic responses.
2. **Nasal Cycle:** A biological rhythm wherein airflow alternates between nostrils due to cyclical congestion and decongestion of nasal tissue. This autonomic phenomenon is foundational to the principles of Swara Yoga.

Physiological Variables: These refer to measurable bodily functions that reflect the internal physical state of participants. In this study, the selected variables include:

1. **Alpha Brainwaves:** Brainwave activity within the 8–12 Hz frequency band, typically observed in relaxed, wakeful states with eyes closed. Associated with mental calmness, reduced anxiety, and a meditative mindset.
2. **Beta Brainwaves:** Neural oscillations ranging from 12.5–30 Hz, linked to active mental engagement, concentration, and heightened alertness. Predominant during problem-solving or focused tasks.
3. **Heart Rate (HR):** Heart rate refers to the number of heart beats per minute and serves as a physiological indicator of cardiac activity and autonomic nervous system function. In this study, heart rate will be measured using a heart rate monitor to assess cardiovascular responses before and after the breathing intervention, reflecting changes in physical and mental states.
4. **Respiratory Rate (RR):** The number of breaths per minute during rest, reflecting pulmonary function. Trained individuals typically demonstrate a lower resting RR due to enhanced lung efficiency and parasympathetic tone.
5. **Muscle Fatigue:** A decline in the muscle's ability to produce force, usually occurring after sustained exertion. It serves as a marker of neuromuscular endurance and physical load tolerance.
6. **Skin Conductance (SC):** Also known as galvanic skin response (GSR), this measures the skin's electrical conductivity, which varies with sweat gland activity. It is commonly used as an index of autonomic nervous system arousal and emotional reactivity.

Psychological Variables: These involve mental and emotional attributes relevant to performance and well-being, assessed using standardized tools.

Mental Skills: In this study, they will be evaluated using the Mental Skills Questionnaire developed by Stephen J. Bull (1996), which assesses performance-related psychological attributes across multiple dimensions.

SIGNIFICANCE OF THE STUDY

This research carries valuable implications for educators, mental health professionals, parents, and wellness practitioners, particularly in the context of adolescent development and academic performance. The significance of the study can be outlined as follows:

a. It aims to provide scientific evidence on the effectiveness of nostril-based breathing practices (Swara Yoga) in enhancing psychological and physiological well-being among school-going students.
b. The study explores the impact of structured breathing techniques on key mental skills such as attention, emotional regulation, and cognitive performance, which are essential for academic and personal success.
c. By examining variations in outcomes across different time durations and breathing methods, the research seeks to identify the most effective intervention protocols for optimizing student performance and well-being.
d. The outcomes may support the inclusion of cost-effective, non-pharmacological approaches like yogic breathing in school health and wellness programs as a tool for managing stress, anxiety, and concentration issues.
e. This study contributes to the integration of traditional yogic practices with contemporary scientific frameworks, offering a bridge between ancient wisdom and modern evidence-based applications in the field of mental skill development.
f. Additionally, it may help students better understand their own psycho-physiological profiles, allowing for more personalized strategies to enhance strengths and address areas of improvement.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter provides an extensive review of the literature concerning various Swara Yoga techniques and their effects on physiological, psychological, and psycho-physiological factors. The studies examined were obtained from academic journals, research articles, and theses to prevent redundancy and fill existing knowledge gaps. These findings aid in the development of research hypotheses and provide context for the study results.

Kayser (1895) was the pioneer in describing the alternating blood flow in the nasal conchae, which is now known as the nasal cycle. This rhythmic change in nasal airflow was further investigated by Stoksted (1953), while Flanagan and Eccles (1997) raised questions about its consistency, revealing that only 21% of participants exhibited regular nasal cycling. ***Shannahoff-Khalsa and Yates (2000)*** evaluated ten physiological rhythms, including the nasal cycle, during both sleep and wakefulness, finding evidence of ultradian rhythms but calling for more clarity regarding the underlying mechanisms.

Eccles (2000) highlighted the role of the autonomic and central nervous systems in regulating nasal airflow through hypothalamic and brainstem vasomotor control. ***Backon (1988)*** discovered that forced breathing through the right nostril elevated blood glucose levels, whereas breathing through the left nostril lowered them. Subsequent research ***(Backon & Kullock, 1989)*** indicated that the involuntary blink rate and intraocular pressure fluctuated depending on the nostril utilized, suggesting sympathetic dominance during right-nostril breathing. ***Shannahoff-Khalsa and Kennedy (1993)*** found that right-nostril breathing increased heart rate at slower breathing rates, while left-nostril breathing decreased heart rate and enhanced stroke volume and end-diastolic volume, underscoring its potential for parasympathetic activation.

Werntz et al. (1983) established a connection between nasal airflow and the dominance of cerebral hemispheres. However, ***Velikonja et al. (1993)*** did not observe such a relationship in untrained individuals, leaving the issue of lateralized brain activation open. Yogic disciplines, especially Swara Yoga, employ controlled nostril breathing to promote relaxation and mental

equilibrium. ***Swami Vivekananda (1973)*** and ***Swami Muktibodhananda (1999)*** emphasized the spiritual and physiological advantages of these practices. ***Telles et al. (1994)*** documented a 37% rise in oxygen consumption after a month of right-nostril breathing. While left and alternate nostril breathing also resulted in increases, they were less pronounced. A follow-up study ***(Telles et al., 1996)*** indicated that right-nostril breathing elevated systolic blood pressure and diminished pulse volume, suggesting heightened sympathetic activity. ***Elangovan (2018)*** investigated the duration of the nasal cycle in both healthy and ill individuals, discovering that abnormal airflow dominance in a nostril was linked to particular health issues, indicating potential for diagnostic use. ***Raghuraj and Telles (2020)*** analyzed the immediate impacts of right, left, and alternate nostril breathing on autonomic and respiratory metrics. Right-nostril breathing was associated with increased blood pressure, whereas left and alternate nostril breathing led to reductions, underscoring the therapeutic promise of customized breathing methods.

Despite numerous studies examining the immediate and comparative effects of various nostril breathing techniques, there is a scarcity of research investigating both their immediate and long-term effects within the same group. Furthermore, few studies have concentrated solely on the effects of these techniques in isolation. Consequently, the present study seeks to evaluate the specific effects of Suryabheda (right), Chandrabheda (left), and Nadi Shodhana (alternate) Pranayama on selected physiological and psychological outcomes, including mental skills and cognitive development in healthy participants.

CHAPTER III

CHAPTER: METHODOLOGY

This chapter will describe the procedure for the selection of subjects, variables, criterion measures, administration of tests, training protocols, study design, and statistical techniques for data analysis.

SELECTION OF SUBJECTS

A total of sixty (60) students from various schools, comprising both male and female individuals aged between 12 and 17 years, will be randomly selected from Gwalior, India. These participants will be evenly distributed into four groups: three experimental groups and one control group, with each group consisting of 15 individuals. The experimental groups will practice three distinct yogic breathing techniques, whereas the control group will not receive any intervention.

SELECTION OF VARIABLES

Following an extensive examination of existing literature, expert insights, the availability of instruments, and the researcher's interest in the issue, the subsequent variables will be chosen:

I. Dependent Variables

a. Physiological Variables:

i. Alpha Brain Waves
ii. Beta Brain Waves
iii. Heart Rate
iv. Respiratory Rate
v. Muscle Fatigue
vi. Skin Conductance

b. Psychological Variable: Mental skills Questionnaire by Stephen J. Bull 1996.

II. Independent Variables

a. **Unilateral breathing technique** (Chandra Bhedana Pranayama – Left nostril dominance)
b. **Unilateral breathing technique** (Surya Bhedana Pranayama – Right nostril dominance)
c. **Bilateral breathing technique** (Nadi Shodhana Pranayama – Alternate nostril breathing)

CRITERION MEASURES

The selected variables will be measured using the following instruments and methods:

Physiological Variables:

a. Alpha and Beta Brain Waves will be assessed through EEG sensors utilizing the Medicaid Bio-feedback machine, following a neuro-feedback testing protocol. The amplitude will be documented in microvolts (μV).
b. Heart Rate will be evaluated using the BVP-Flex/Pro Sensor, with results recorded in beats per minute (bpm).
c. Respiratory Rate will be determined using the Respiration Sensor from the Medicaid Bio-feedback machine, noted in breaths per minute.
d. Muscle Fatigue will be quantified with the MyoScan-Pro EMG Sensor, represented in microvolts (μV).
e. Skin Conductance will be gauged using the SC-Flex/Pro Sensor from the Medicaid Bio-feedback machine, recorded in micro-siemens (μS).

Psychological Variable:

a. Mental Skills: The evaluation of mental skills will be conducted using Bull's Mental Skills Questionnaire (1996), which measures various subscales including imagery, mental preparation, self-confidence, anxiety and worry management, concentration, relaxation, and motivation. The findings will be reported as a percentage.

COLLECTION OF DATA AND ADMINISTRATION OF TESTS

The experimental groups will participate in designated breathing technique interventions, whereas the control group will not receive any such training. Data collection will take place in three stages: Baseline Test (Pre-test), which will be administered in Week 0 prior to the initiation of any intervention; Mid-Test, scheduled for the conclusion of Week 6; and Post-Test, to be conducted at the end of Week 12.

STATISTICAL ANALYSIS

Physiological Variables: A Mixed-design Repeated Measures ANOVA will be utilized to evaluate the impact of various training protocols over time, with a significance threshold established at 0.05.

Psychological Variable (Mental Skills): A Two-Way Mixed MANOVA will be implemented to analyze the average scores of mental skills at different time points (pre-test, mid-test, post-test), also with a significance level set at 0.05.

EXPECTED OUTCOME

The study is expected to demonstrate the significant effects of nostril-specific breathing techniques: Suryabheda, Chandrabheda, and Nadi Shodhana Pranayama, on a range of physiological and psychological variables in school-going students aged 12 to 17. It is anticipated that these breathing techniques will lead to improvements in physiological markers such as heart rate, respiratory rate, muscular fatigue, skin conductance, and brainwave activity (both alpha and beta waves), which are linked to relaxation, focus, and energy levels. Psychologically, the study is expected to reveal notable changes in mental skills, including better attention, enhanced anxiety and worry management, and improved cognitive performance. These results could potentially provide valuable insights into how structured, natural techniques like Swara Yoga can optimize student well-being, foster academic performance, and support emotional balance. With significant evidence backing the positive effects of nostril breathing practices, the research could pave the way for integrating Swara Yoga into educational settings as a potent tool for enhancing mental health and overall student performance.

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